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Please find below and/or attached an Office communication concerning this application or proceeding.

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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 09/603,132
Filing Date: June 23, 2000
Appellant(s): VAARTSTRA ET AL.

Loren D. Albin
For Appellant

EXAMINER'S ANSWER

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This is in response to the appeal brief filed 12/18/06 appealing from the Office action mailed 7/21/06.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

5,907,789	KOMATSU	5-1999
6,239,460 B1	KUROIWA	5-2001
5,017,551	AGOSTINELLI	5-1991
5,872,041	LEE	2-1999
5,122,923	MATSUBARA	6-1992
5,897,350	LEE	4-1999

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

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2. Claims 45 thru 48, and 54 thru 59 are rejected under 35 U.S.C. 102(e) as being anticipated by Komatsu 5,907,789. Komatsu discloses (see, for example, FIG. 7C) a semiconductor device comprising a silicon semiconductor substrate (substrate assembly) 70, and metal silicide layer (diffusion barrier layer) 120. In column 22, lines 29-44, Komatsu discloses the metal silicide layer may be made of ruthenium. Komatsu also discloses that various methods can be used to form the metal silicide such as physical vapor-phase growth method or chemical vapor-phase growth method.

Regarding claims 46, and 47, see, for example, column 5, lines 56-65, wherein Komatsu discloses that x may be 2.

Regarding claim 48, see, for example, column TiN layer (one or more additional conductive layers) 114.

Regarding claim 54, see, for example, FIG. 7C wherein Komatsu discloses a MOSFET (active device) 105 and metallization material (interconnect) 118.

Regarding claim 56, see, for example, FIG. 7C wherein Komatsu discloses a TiN layer (conductive contact material) 114.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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4. Claims 45, 46, 50, 51, 57 thru 59, and 63 thru 65 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kuroiwa et al. 6,239,460 B1 in view of Agostinelli et al. 5,017,551. Kuroiwa discloses (see, for example, FIG. 10) a capacitor structure comprising a metal electrode (first electrode) 130/132, capacitor dielectric 115 and upper electrode (second electrode) 116. In column 13, lines 11-15, Kuroiwa discloses the ruthenium silicide layer 132 is formed from a portion of metal electrode 130. Kuroiwa does not disclose at least one of the first and second electrode comprising a chemical vapor diffusion barrier layer. However, Agostinelli discloses (see, for example, column 4, lines 22-33) a metal silicide layer made of ruthenium. Agostinelli also discloses (see, for example, column 20, lines 11-16) that various, convenient methods can be used to form the metal silicide such as chemical vapor deposition procedures. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to have at least one of the first and second electrode comprising a chemical vapor diffusion barrier layer in order to conveniently form a electrode with adequate conductive properties.

Regarding claims 58, 59, 64, and 65, Kuroiwa discloses the ruthenium silicide layer (conformal layer) 132 within an opening of the insulating film 110. The aspect ratio (ratio of height to width) is clearly greater than 1.

Regarding claim 63, Kuroiwa discloses (see, for example, FIG. 10) a capacitor comprising a metal electrode (first electrode) 130, capacitor dielectric film (high dielectric material) 115, upper electrode (second electrode) 116, and ruthenium silicide layer (diffusion barrier layer) 132.

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5. Claims 48, 49, 54, 55, and 69 thru 74 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kuroiwa et al. '460 B1 in view of Agostinelli et al. '551 as applied to claims 45, 46, 50, 51, 57-59, and 63-65 above, and further in view of Lee et al. 5,872,041. Kuroiwa in view of Agostinelli does not disclose a silicon containing region. However, it was well known in the art to use a substrate made of silicon (silicon containing region). Lee discloses (see, for example, column 2, lines 23-29) a semiconductor device on a silicon substrate 300. It would have been obvious to one of ordinary skill in the art at the time of invention to use a silicon containing region in order to form a semiconductor device and have diffused regions formed therein since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

Regarding claims 48 and 49, Kuroiwa discloses (see, for example, FIG. 10) a metal electrode (one or more additional conductive layers) 130 and column 9, lines 39-42 wherein Kuroiwa discloses the metal electrode comprising ruthenium (Ru) or iridium (Ir).

Regarding claim 54, Kuroiwa discloses (see, for example, FIG. 10) a DRAM (integrated circuit structure) comprising a substrate assembly including a substrate (silicon containing region) 101, transfer gate transistor (active device) 103b, and a plug (interconnect) 111 including a ruthenium silicide layer 132.

Regarding claim 69, Lee discloses (see, for example, column 2, lines 23-29) the substrate may be germanium or gallium-arsenide.

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6. Claims 52, and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kuroiwa et al. '460 B1 in view of Agostinelli et al. '551 in view of Lee et al. '041 as applied to claims 48, 49, 54, 55, and 69-74 above, and further in view of Matsubara et al. 5,122,923. Kuroiwa in view of Agostinelli in view of Lee does not disclose the first electrode comprising one or more additional conductive layers. However, it was well known in the art at the time of invention to use multiple layers in the electrodes of a capacitor. In column 4, lines 25-27, Matsubara discloses a lower electrode comprising multiple layers of ruthenium, ruthenium oxide, ruthenium silicide and stacked structures consisting of these materials. It would have been obvious to one of ordinary skill in the art at the time of invention to have the first electrode comprising one or more additional conductive layers in order to form an adequate bottom electrode, and since it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art. *St. Regis paper Co. vs. Bemis Co.*, 193 USPQ 8.

7. Claims 60 thru 62, and 66 thru 68 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kuroiwa et al. '460 B1 in view of Agostinelli et al. '551 as applied to claims 45, 46, 50, 51, 57-59, and 63-65 above, and further in view of Lee 5,897,350. Kuroiwa in view of Agostinelli does not disclose the opening having an aspect ratio greater than about 3. However, Lee '350 discloses (see, for example, FIG. 4B) a semiconductor device comprising a contact hole (opening) 32 having an aspect ratio greater than 3. It would have been obvious to one of ordinary skill in the art at the time of invention to have the opening have an aspect ratio greater than about 3 in order to provide higher integration in a semiconductor device since it has been held to be within the general skill of a worker in the art to select a known material on the

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basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

(10) Response to Argument

Regarding the appellant's argument on page 6, last paragraph of the appeal brief filed 12/18/06 that Komatsu would have failed to provide an enabling disclosure of a chemical vapor codeposited diffusion barrier layer formed of RuSix, this argument is not persuasive. Whether Komatsu teaches an enabling disclosure does not change the fact that Komatsu expressly discloses (see, for example, FIG. 7C, and column 22, lines 29-44) a diffusion layer 120 made of metal silicide wherein the metal is specifically stated as ruthenium, which is formed by CVD (or chemical vapor deposition). Enablement of an already issued patent is presumed and the burden is on the appellant to provide facts to rebut this presumption of operability. However, the appellant has not provided any facts why the RuSix diffusion barrier layer would not be enabled exactly the same way as the other metals disclosed in the reference except that it has not been described as the main focus as other metal silicides in the reference. This is hardly enough to show lack of enabling disclosure since Komatsu clearly states ruthenium as one of a selective list of similar metals without any inkling by Komatsu that ruthenium would change this enablement, and be any different than the enablement of other metals in the reference, much less that any undue experimentation would be required in its enablement. Instead, the appellant has only provided secondary information that say nothing about why a RuSi diffusion barrier layer could not be enabled in exactly the same manner as the other metals. There is nothing in Komatsu,

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which would suggest that ruthenium would not be enabled like the other metal silicides. It would be expected that exactly the same enablement that was used for the other metal silicides in Komatsu would equally apply to RuSix, and there is nothing in the reference to suggest otherwise.

Regarding appellant's argument on page 7 that the mere naming of ruthenium as "one of many metals" that may be used as a metal silicide layer is insufficient to provide an enabling disclosure such that the public was in possession of the claimed invention, this argument is not persuasive. In column 22, lines 29-39, Komatsu indisputably states a metal silicide layer made of silicide and a metal such as ruthenium, and further states that CVD may be used in its formation. Such a disclosure is more than a "germ" of an idea and clearly states the metal used and its method of making (even though the claims are directed towards product) in the formation of the metal silicide layer. Regarding the appellant's argument on page 9, first paragraph that Komatsu does not bluntly state "a metal silicide layer made of silicon and a metal such as ruthenium", this argument is not persuasive. As stated above, Komatsu clearly discloses a metal silicide layer wherein one of the metals listed may be ruthenium. It is not clear what the appellant's statement "the Examiner mischaracterized his own characterization of Komatsu to support his argument" in the first paragraph of page 9 means. It is indisputably stated by Komatsu that ruthenium silicide may be used as the metal silicide, and therefore, will be understood as such by the Examiner, and anyone of ordinary skill in the art reading Komatsu.

Regarding appellant's argument on page 10, first paragraph that Komatsu fails to enable chemical vapor codeposition of a diffusion barrier layer formed of RuSix, an assertion that the Examiner has failed to counter with a showing of how a diffusion barrier layer formed of RuSix,

is enabled, this argument is not persuasive. First of all, all prior art is presumed to be enabled. It is the burden of the applicant to provide facts to rebut this presumption of operability. MPEP 2121. Like stated above, there is nothing in the reference that would suggest that the RuSix layer is not enabled in Komatsu. Komatsu clearly states the layer is formed by chemical vapor deposition, and there is no reason in Komatsu to assume that the RuSi layer would not be enabled in exactly the same way as the other metal silicide layers, and without undue experimentation.

Regarding the appellant's argument on page 11, last paragraph that Komatsu neither suggests nor discloses precursor compositions, chemical vapor deposition systems, or conditions required for chemical vapor codeposition of a diffusion barrier layer formed of RuSix, this argument is not persuasive. The claims are directed towards device, and these methods (i.e. discloses precursor compositions, chemical vapor deposition systems, or conditions required for chemical vapor codeposition) do not change what is already disclosed in Komatsu, a RuSix diffusion barrier layer made by chemical vapor deposition. These methods do not change what is disclosed by Komatsu.

Regarding the applicant's argument on page 12, second paragraph that Agostinelli fail to provide an enabling disclosure of a chemical vapor codeposited diffusion barrier layer formed of RuSix, this argument is not persuasive. Agostinelli clearly discloses (see, for example, column 4, lines 22-33) a ruthenium silicide barrier layer by stating a metal in the form of silicide chosen from a platinum group metal, which includes ruthenium. Agostinelli further discloses (see, for example, column 20, 11-15) that the barrier layers may be formed by other convenient conventional preparation processes such as chemical vapor deposition. This is not a suggestion,

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or a mere germ of an idea, but a clear disclosure of a ruthenium silicide layer formed by chemical vapor deposition. Further, like stated above, there is nothing in the reference to suggest that the ruthenium silicide can not be made by the conventional preparation processes such as chemical vapor deposition as stated by Agostinelli. The appellant's statement on page 15, second paragraph that there are no working examples of a barrier layer formed of ruthenium silicide is not persuasive. Agostinelli clearly discloses a ruthenium silicide layer and because it is not explained as in depth as other layers does not mean it is not enabled, much less not disclosed in the reference. There is no reason to assume that ruthenium silicide is not enabled like the other metal silicides or that undue experimentation would be required in its enablement. The appellant's argument on page 16, first paragraph that Agostinelli fails to provide direction to the skilled person to enable a chemical vapor codeposited diffusion barrier layer formed of RuSix is not persuasive. Agostinelli clearly discloses a barrier layer made of RuSix, which can be made by a conventional process such as chemical vapor deposition. Like stated above, there is nothing in the reference to suggest that the ruthenium silicide would not be enabled in exactly the same way as the other metal silicide barrier layers in the reference. Agostinelli is simply used to show that a diffusion barrier layer made of RuSix can be made by another process such as chemical vapor deposition, which it clearly does.

Regarding the appellant's argument on page 17, last paragraph that Kuroiwa fail to teach or suggest a diffusion barrier layer including a conformal layer within the opening, this argument is not persuasive. In Fig. 10, Kuroiwa clearly discloses a conformal layer 132 made of RuSix in an opening 110a, therefore, this argument is not persuasive.

Regarding the appellant's argument on page 18, last paragraph that Lee '041 does not teach or suggest a RuSix diffusion barrier layer, this argument is not persuasive. Lee '041 is only used to show that the substrate may be formed of silicon. The RuSix diffusion barrier layer is already disclosed in Kuroiwa in view of Agnostelli as discussed above, and it is not required that these elements must also be disclosed in Lee '041 since Lee '041 only used to show that a substrate may be made of silicon, a very well known fact in the semiconductor art.

Regarding the appellant's argument on page 19, first paragraph that Kuroiwa clearly discloses the deposition of ruthenium on a silicon containing surface, this argument is not persuasive. In claims 69-74, the applicant states "the surface defining the opening is not a silicon containing surface". In Fig. 8, Kuroiwa discloses an insulating film (surface) 110, which is a dielectric above the silicon-containing substrate. The plug 111 in the opening is not on the surface of the insulating film but is etched inside the insulating film, and therefore, the plug is not part of the surface defining the opening since the insulating film 110 defines the opening, and not the plug.

Regarding the appellant's argument on page 20, third paragraph that it is unclear how Matsubara discloses "layers of ruthenium, ruthenium oxide, ruthenium silicide and stacked structures consisting of these materials, wherein "the first electrode comprises a diffusion barrier layer, wherein the diffusion barrier layer of the first electrode is formed on at least a portion of a silicon containing region, and further wherein the first electrode comprises one or more additional conductive layers formed over the diffusion barrier layer, the one or more additional conductive layers formed of at least one of a metal and a conductive metal oxide", this argument is not persuasive. Matsubara is only used to show that a bottom electrode can comprise more

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than one layer. The limitations regarding the ruthenium silicide was already disclosed in Kuroiwa in view of Agostinelli in view of Lee as described above, and the additional conductive layers disclosed in Matsubara is not dependent on the RuSix diffusion barrier layer. Matsubara is only used to show that a bottom electrode of a capacitor may comprise additional layers.

Regarding the appellant's argument on page 22, last paragraph that Lee '350 fails to disclose or suggest a chemical vapor codeposited RuSix diffusion barrier layer, this argument is not persuasive. The chemical vapor codeposited RuSix diffusion barrier layer is already disclosed by Kuroiwa in view of Agostinelli, and Lee '350 is only used to disclose an opening having an aspect ratio greater than 3. Therefore, such a disclosure (i.e. a chemical vapor codeposited RuSix diffusion layer) in Lee is not required since it is already disclosed in Kuroiwa in view of Agostinelli.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Eugene Lee



Conferees:

Ken Parker
SPE



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AU 2815

Darren Schuberg

SPE

AU 2834

A handwritten signature in black ink, appearing to be 'DS' or similar, located to the right of the name 'Darren Schuberg'.